What is claimed is:

1. A method of for quantum modulating optical signals by using a nonlinear optical medium, wherein the nonlinear optical medium includes two closely spaced ground states |1> and |2> such that the transition among the ground states is dipole forbidden, and an excited state |3> such that two-photon transition between the ground states |1> and |2> via the excited state |3> is allowed, the method comprising the steps of:

a) applying a first continuous wave (cw) laser light as an input to the nonlinear optical medium through an optical fiber or free space at a frequency of ω_α corresponding to a first transition between the ground state |1> and the excited state |3>;

b) applying a second laser light to the nonlinear optical medium through an optical fiber or free space at a frequency of ω_β corresponding to a second transition between the ground state |2> and the excited state |3>;

c) adjusting the intensities of the first laser light ω_α and the second laser beam ω_β to produce a strongly driven superposition state composed of the ground state |1> and the |2> creating two-photon coherence induction $\mathrm{Re}\rho_{12}$;

d) applying a third laser light to the nonlinear optical

medium through an optical fiber or free space at a frequency of ω_p corresponding to a third transition between the ground state |2> and the excited state |3> for nondegenerate four-wave mixing or phase conjugation geometry with the first laser light ω_α, the second laser light ω_β, and the third laser light ω_p to produce nondegenerate four-wave mixing signal ω_d; and

e) connecting the nondegenerate four-wave mixing signals ω_d to an optical fiber.

2. The method of claim 1, wherein the excited state |3> is selected such that its energy level is higher than the energy level of the ground state |1> and the |2>.

3. The method of claim 1, wherein the ground state |2> is selected such that its energy level is higher than the energy level of the ground state |1>.

4. The method of claim 1, wherein the second laser light ω_β and the third laser light ω_p are synchronized to satisfy a temporal and spatial overlap of the laser lights ω_α, ω_β and ω_p in the nonlinear optical medium, and frequency difference δ_p between the second laser light ω_β and the third laser light ω_p is near the Rabi frequency Ω_p of the ω_p.

5. The method of claim 1, wherein the second laser light ω_β and the third laser light ω_p are synchronized to satisfy a temporal and spatial overlap of the laser light ω_α with the ω_β and the ω_p, but keeping temporal delay of the laser lights ω_p from the ω_β by ι no longer than phase decay time T2 among the two ground states |1> and |2> with negligible frequency difference δ_p between the second laser light ω_β and the third laser light ω_p.

6. A method for quantum modulating optical signals by using a nonlinear optical medium, wherein the nonlinear medium includes two closely spaced ground states |1> and |2> such that the transition between the ground states is dipole forbidden, and two closely spaced excited states |3> and |4> such that the transition between the excited states is dipole forbidden, and such that two-photon transition between the ground state |1> and the |2> via the excited state |3> or |4> is allowed, the method comprising the steps of:

f) applying a first continuous wave (cw) laser light as an input to the nonlinear optical medium through an optical fiber or free space at a frequency of ω_α corresponding to a first transition between the ground state |1> and the excited state |3>;

g) applying a second laser light to the nonlinear optical

medium through an optical fiber or free space at a frequency of ω_β corresponding to a second transition between the ground state |2> and the excited state |3>;

h) adjusting the intensities of the first laser light ω_α and the second laser beam ω_β to produce a strongly driven superposition state composed of the ground state |1> and the |2> creating two-photon coherence induction $\mathrm{Re}\rho_{12}$;

i) applying a third laser light to the nonlinear optical medium through an optical fiber or free space at a frequency of ω_p corresponding to a third transition between the ground state |2> and the excited state |4> for nondegenerate four-wave mixing or phase conjugation geometry with the first laser light ω_α, the second laser light ω_β, and the third laser light ω_p to produce nondegenerate four-wave mixing signal ω_d; and

j) connecting the nondegenerate four-wave mixing signals ω_d to an optical fiber.

7. The method of claim 6, wherein the excited states |3> and |4> are selected such that their energy levels are higher than the energy level of the ground state |1> and the |2>.

8. The method of claim 6, wherein the ground state |2> is selected such that its energy level is higher than the energy level of the ground state |1>.

9. The method of claim 6, wherein the second laser light ω_β and the third laser light ω_p are synchronized to satisfy a temporal and spatial overlap of the laser lights ω_α, ω_β and ω_p in the nonlinear optical medium, and frequency difference δ_p between the second laser light ω_β and the third laser light ω_p is the same as the frequency difference between the excited states |3> and |4>.

10. The method of claim 6, wherein the second laser light ω_β and the third laser light ω_p are synchronized to satisfy a temporal and spatial overlap of the laser light ω_α with the ω_β and the ω_p, but keeping temporal delay of the laser lights ω_p from the ω_β by ι no longer than phase decay time T2 among the two ground states |1> and |2> with negligible frequency difference δ_p between the second laser light ω_β and the third laser light ω_p.

11. An apparatus for quantum modulating optical signals by using a nonlinear optical medium, wherein the nonlinear medium includes two ground states |1> and |2> such that the transition between the ground states |1> and |2> is dipole forbidden, and an excited states |3> such that two-photon transition between the ground states |1> and |2> via the

excited state |3> is allowed, the apparatus comprising:

a) a first laser light source for applying to the nonlinear optical medium at a frequency of ω_1 corresponding to a first transition between the ground state |1> and the excited state |3>;

b) a second laser light source for applying to the nonlinear optical medium at a frequency of ω_2 corresponding to a second transition between the ground state |2> and the excited state |3>;

c) a means of splitting a third laser light from the second laser light for applying to the nonlinear optical medium at a frequency of ω_p corresponding to a third transition between the ground state |2> and the excited state |3>; and

d) a means for adjusting the intensities and the frequencies of the first light, the second light, and the third light to produce a coherent superposition state of the ground state |1> and the |2>.

12. The apparatus of claim 11, wherein the nonlinear optical medium is a solid.

13. The apparatus of claim 11, wherein the nonlinear optical medium is a doubly coupled semiconductor quantum wells.

14. The apparatus of claim 13, wherein the two ground states |1> and |2>, and the excited state |3> are selected in conduction band of the doubly coupled semiconductor quantum wells.

15. The apparatus of claim 11, wherein the first laser light source delivers single-mode light.

16. An apparatus for quantum modulating optical signals by using a nonlinear optical medium, wherein the nonlinear optical medium includes two ground states |1> and |2> such that the transition between the ground states |1> and |2> is dipole forbidden, and two excited state |3> and |4> such that the transition between the excited states |3> and |4> is dipole forbidden, and such that two-photon transition between the ground states |1> and |2> via the excited state |3> or the excited state |4> is allowed, the apparatus comprising:

a) a first laser light source for applying to the nonlinear optical medium at a frequency of ω_1 corresponding to a first transition between the ground state |1> and the excited state |3>;

b) a second laser light source for applying to the nonlinear optical medium at a frequency of ω_2 corresponding to

a second transition between the ground state |2> and the excited state |3>;

c) a means of splitting a third laser light from the second laser light for applying to the nonlinear optical medium at a frequency of ω_p corresponding to a third transition between the ground state |2> and the excited state |4>; and

d) a means for adjusting the intensities and the frequencies of the first light, the second light, and the third light to produce a coherent superposition state of the ground state |1> and the |2>.

17. The apparatus of claim 16, wherein the nonlinear optical medium is a solid.

18. The apparatus of claim 16, wherein the nonlinear optical medium is a doubly coupled semiconductor quantum wells.

19. The apparatus of claim 18, wherein the two ground states |1> and |2>, and the two excited states |3> and |4> are selected in conduction band of the doubly coupled semiconductor quantum wells.

20. The apparatus of claim 16, wherein the first laser

light source delivers single-mode light.